

Application No. 09/880,243
Amendment "A" dated September 16, 2004
Reply to Office Action mailed August 3, 2004

AMENDMENTS TO THE CLAIMS

The listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (Currently Amended) In a system including a compressed video stream that has a bit rate that is higher than a desired bit rate, a method for transcoding the video stream such that the bit rate of the video stream is reduced, the method comprising acts of:

obtaining original sets of quantized transform coefficients from the video stream;

updating an original quantization level of the original sets of quantized transform coefficients to a new quantization level, wherein updating the original quantization level includes at least one of:

an act of computing a matrix ratio between a new quantization matrix and a current quantization matrix of the video stream; or

an act of computing a scale ratio between a new quantization scale and a current quantization scale of the video stream;

generating new sets of transform coefficients using the new quantization level such that the new sets of transform coefficients are more coarsely quantized; and encoding the new transform coefficients.

2. (Original) A method as defined in claim 1, wherein the transform coefficients are discrete cosine transform coefficients.

3. (Original) A method as defined in claim 1, wherein the transform coefficients are wavelet transform coefficients.

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4. (Original) A method as defined in claim 1, wherein the quantized transform coefficients of the video stream are encoded and wherein the act of obtaining original sets of quantized transform coefficients further comprises an act of decoding the quantized transform coefficients.

5. (Original) A method as defined in claim 1, further comprising an act of performing an inverse quantization on the quantized transform coefficients to produce unquantized coefficients that approximate the original unquantized coefficients.

6. (Original) A method as defined in claim 5, further comprising an act of performing a more coarse quantization on the original unquantized coefficients.

7. (Original) A method as defined in claim 1, wherein the quantization level includes at least one of a quantization matrix and a quantization scale and wherein the act of updating an original quantization level of the original quantized transform coefficients further comprises one or more of:

- an act of selecting a new quantization matrix; and
- an act of selecting a new quantization scale.

8. (Cancelled).

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9. (Currently Amended) In a system that receives an input signal, the input signal including a video stream that is compressed, wherein a bit rate of the video stream is higher than a desired bit rate, a method for transcoding the video stream such that the bit rate of the video stream is reduced, the method comprising acts of:

obtaining original sets of quantized discrete cosine transform coefficients from the video stream corresponding to macroblock data;

updating an original quantization level of the original sets of quantized discrete cosine transform coefficients to a new quantization level, wherein updating the original quantization level includes at least one of:

an act of computing a matrix ratio between a new quantization matrix and a current quantization matrix of the video stream; or

an act of computing a scale ratio between a new quantization scale and a current quantization scale of the video stream;

generating new sets of discrete cosine transform coefficients using the new quantization level such that the new sets of discrete cosine transform coefficients are more coarsely quantized than the original sets of quantized discrete cosine transform coefficients; and

encoding the new discrete cosine transform coefficients, wherein fewer bits are needed to encode the new sets of discrete cosine transform coefficients.

10. (Original) A method as defined in claim 9, wherein the act of obtaining original sets of quantized discrete cosine transform coefficients from the video stream further comprises:

an act of performing an inverse run level coding on the video stream.

11. (Original) A method as defined in claim 9, wherein the act of obtaining original sets of quantized discrete cosine transform coefficients from the video stream further comprises:

an act of performing an inverse variable length coding on the video stream.

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12. (Original) A method as defined in claim 9, wherein the quantization level includes a quantization matrix and a quantization scale and wherein the act of updating an original quantization level of the original sets of quantized discrete cosine transform coefficients further comprises one or more of:

- an act of selecting a new quantization matrix; and
- an act of selecting a new quantization scale.

13. (Currently Amended) A method as defined in claim 9, wherein the act of updating an original quantization level of the original sets of quantized discrete cosine transform coefficients further comprises ~~at least one of:~~

~~an act of computing a matrix ratio of a new quantization matrix to a current quantization matrix, the current quantization matrix included in the original quantization level;~~

~~an act of computing a scale ratio of a new quantization scale to a current quantization scale, the current quantization scale included in the original quantization level; and~~

an act of refraining from computing either the matrix ratio or the scale ratio.

14. (Original) A method as defined in claim 13, further comprising an act of pre-computing the matrix ratio and the scale ratio for each potential value of the new quantization scale and the new quantization matrix.

15. (Original) A method as defined in claim 14, wherein the act of pre-computing the matrix ratio occurs at one or more of: per frame, per macroblock, per slice, and per picture of the video stream.

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16. (Original) A method as defined in claim 14, wherein the act of pre-computing the scale ratio occurs at one or more of: per frame, per macroblock, per slice, and per picture of the video stream.

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17. (Currently Amended) In a system including a set top box that receives a transport stream, wherein the transport stream includes one or more compressed video streams, a method for transcoding a video stream included in the transport stream to reduce a bit rate of the video stream, the method comprising steps for:

performing an inverse coding on the video stream such that original quantized discrete cosine transform (DCT) blocks are known;

selecting at least one of a new quantization matrix and a new quantization scale for the original quantized DCT blocks by determining a matrix ratio between the new quantization matrix and an original quantization matrix, determining a scale ratio between the new quantization scale and an original quantization scale, and multiplying the matrix ratio with the scale ratio;

re-quantizing the original quantized DCT blocks using at least one of the new quantization matrix and the new quantization scale; and

performing a coding on the re-quantized DCT blocks such that the bit rate of the video stream is reduced.

18. (Original) A method as defined in claim 17, wherein the step for performing an inverse coding further comprises steps for:

performing an inverse variable length coding; and

performing an inverse run level coding.

19. (Original) A method as defined in claim 17, wherein the step for selecting at least one of a new quantization matrix and a new quantization scale occurs at one or more of: once per frame, once per picture, once per slice, and once per macroblock.

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20. (Original) A method as defined in claim 17, wherein the step for re-quantizing the original quantized DCT blocks using at least one of the new quantization matrix and the new quantization scale occurs without performing an inverse quantization of the original quantized DCT blocks.

21. (Cancelled).

22. (Original) A method as defined in claim 20, further comprising a step of accounting for non linearity of the original quantized DCT blocks using a pre-quantization factor and a post quantization factor.

23. (Original) A method as defined in claim 17, wherein the step for re-quantizing the original quantized DCT blocks using at least one of the new quantization matrix and the new quantization scale further comprises steps for:

adjusting the original quantized DCT blocks by applying a pre-quantization factor to the original quantized DCT blocks, wherein the pre-quantization factor is dependent on whether the original quantized DCT blocks are intra blocks or non-intra blocks;

combining the adjusted original quantized DCT blocks with a product of a matrix ratio and a scale ratio to produce new quantized DCT blocks; and

adjusting the new quantized DCT blocks to account for non-linearity by applying a post-quantization factor, wherein the post quantization factor is dependent on whether the new quantized DCT blocks are intra blocks or non-intra blocks, wherein the adjusted new quantized DCT blocks correspond to re-quantized DCT blocks.

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24. (Original) A method as defined in claim 17 wherein the step for performing a coding on the re-quantized DCT blocks further comprises steps for:

performing a run level coding; and

performing a variable length coding.

25. (Original) A method as defined in claim 17 further comprising an act of refraining from performing compensation on the video stream for errors introduced in reference frames of the video stream.

26-34. (Cancelled).

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35. (Original) In a system that receives a transport stream that includes one or more video streams whose bit rate is higher than a desired bit rate, a transcoder for transcoding a video streams such that a bit rate of the video stream is reduced, the transcoder comprising:

a first multiplier for producing a ratio product between a matrix ratio and a scale ratio, wherein the matrix ratio is a new quantization matrix to an old quantization matrix and wherein the scale ratio is a new quantization scale to an old quantization scale;

a first rounder for rounding the ratio product;

a first adder for combining original discrete cosine transform (DCT) coefficients with a pre-compensation factor, wherein the pre-compensation factor is selected using a first multiplexer;

a second multiplier that multiplies an output of the first adder with the rounded ratio product to produce preliminary DCT coefficients; and

a second adder for combining a post compensation factor with the preliminary DCT coefficients to generate re-quantized DCT coefficients, wherein the re-quantized DCT coefficients are encoded with fewer bits such that the bit rate of the video stream is reduced.

36. (Original) A transcoder as defined in claim 35, wherein the pre-compensation factor selected by the first multiplexer is dependent on whether the block of the video stream being transcoded is an intra block or a non-intra block.

37. (Original) A transcoder as defined in claim 36, wherein the pre-compensation factor selected by the first multiplexer is dependent on a magnitude of the original DCT coefficients.

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38. (Original) A transcoder as defined in claim 35, wherein the post-compensation factor selected by the second multiplexer is dependent on whether the block of the video stream being transcoded is an intra block or a non-intra block.

39. (Original) A transcoder as defined in claim 38, wherein the post-compensation factor selected by the second multiplexer is dependent on a magnitude of the preliminary DCT coefficients.

40. (Original) A transcoder as defined in claim 38, wherein the new quantization matrix and the new quantization scale are selected by a user.

41. (Original) A transcoder as defined in claim 38, wherein the new quantization matrix and the new quantization scale are selected to accommodate at least one of bandwidth available to the video stream and storage of the set top box.

42. (Original) A transcoder as defined in claim 38, wherein the reduced bit rate of the video stream optimally utilizes at least one of available bandwidth and storage of the set top box.

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43. (Currently Amended) In a system including a set top box that receives a transport stream that includes at least one video stream, wherein the video stream has a bit rate that higher than a desired bit rate, a computer program product for implementing a method for transcoding the video stream such that the bit rate is reduced, the computer program product comprising:

a computer readable medium for carrying machine-executable instructions for implementing the method; and wherein the method comprises acts of:

performing an inverse ~~variable-length~~ coding (VLC) on the video stream such that original quantized discrete cosine transform (DCT) coefficients are known;

selecting at least one of a new quantization matrix and a new quantization scale for the original quantized DCT coefficients by determining a matrix ratio between the new quantization matrix and an original quantization matrix, determining a scale ratio between the new quantization scale and an original quantization scale, and multiplying the matrix ratio with the scale ratio;

re-quantizing the original quantized DCT coefficients using at least one of the new quantization matrix and the new quantization scale; and

performing a ~~variable-length~~ coding on the re-quantized DCT coefficients such that the bit rate of the video stream is reduced.

44. (Cancelled).

45. (Original) A computer program product as defined in claim 43, the method further comprising an act of accounting for non linearity of the original quantized DCT coefficients.

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46. (Original) A computer program product as defined in claim 43, wherein the act of re-quantizing the original quantized DCT coefficients using at least one of the new quantization matrix and the new quantization scale further comprises acts of:

rounding the original quantized DCT coefficients, wherein the rounding is dependent on whether the original quantized DCT coefficients are intra blocks or non-intra blocks;

combining the rounded original quantized DCT coefficients with a product of a matrix ratio and a scale ratio to produce new quantized DCT coefficients; and

rounding the new quantized DCT coefficients to account for non-linearity, wherein the rounding is dependent on whether the new quantized DCT coefficients are intra blocks or non-intra blocks, wherein the rounded new quantized DCT coefficients correspond to re-quantized DCT coefficients.

47. (Original) A computer program product as defined in claim 43, wherein the act of performing a variable length coding on the re-quantized DCT coefficients further comprises an act of performing a run level coding on the re-quantized DCT coefficients.

48. (Original) A computer program product as defined in claim 43, the method further comprising an act of refraining from performing motion compensation on the video stream.